

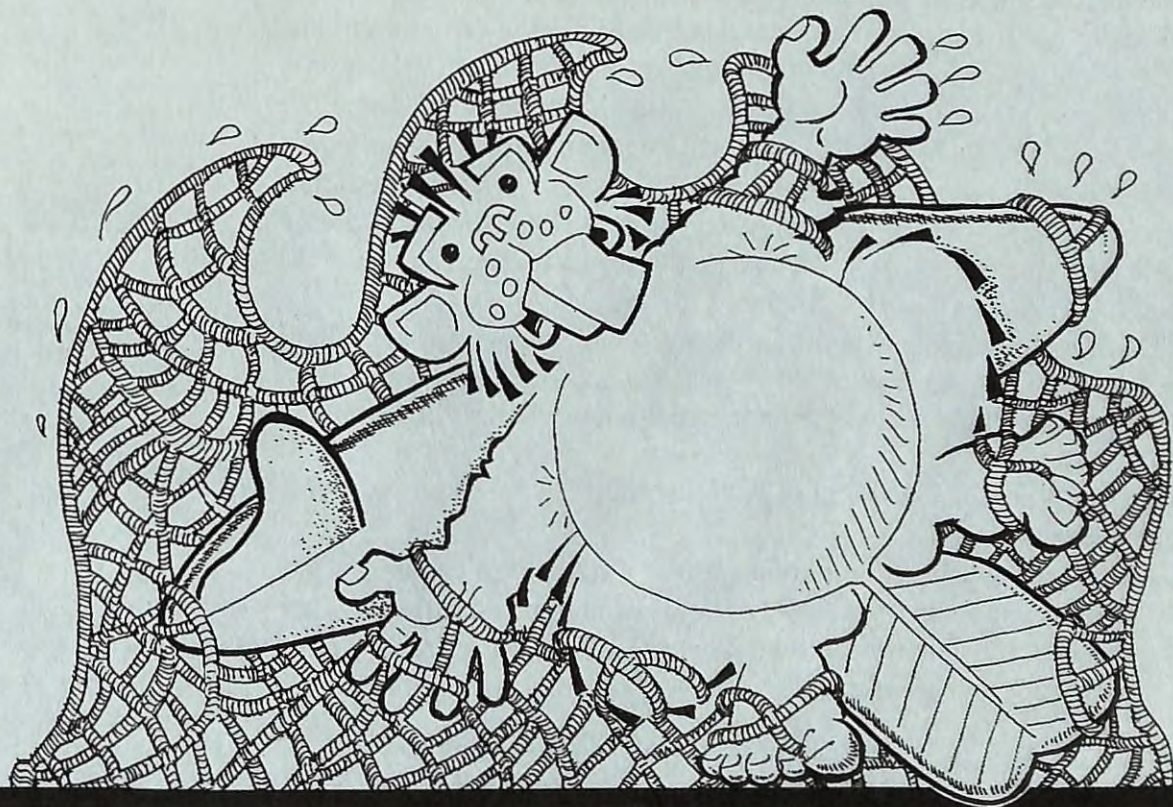
# solplan review

*the independent journal of energy conservation, building science & construction practice*

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## Surfing the 'net





## From the Editor . . .

Today the business agenda dominates public life. Public institutions are being privatized, whether or not it makes policy, business or economic sense. The most disparaging comment that can be made of some public sector group is something to the effect that "they couldn't even run a peanut stand".

This of course ignores that some of the biggest blunders in the public accounts for which we and succeeding generations are being asked to repay were instituted by the supposedly respectable decision makers coming from the business world. There's no need to name names.

What's that got to do with the construction industry? At every turn we are being told that we must be competitive in the global marketplace. There seems to be no room for anything other than the bottom line. Everything has to have a price tag to it - it doesn't seem possible to make a decision based on inherent value to society. With so much emphasis on the marketplace, you would think that every business would carefully nurture prospective business opportunities. Yet there are times I marvel at the business practices of corporations.

What brought these thoughts to mind was the response I received to enquiries I recently made. I decided it was time to follow up on changes in the ventilation industry, so I contacted all HRV manufacturers of which there are a number of new players, especially in the USA. The enquiry asked for a current catalogue, especially information on new product lines. In other words, the kind of information any builder or designer may ask for, except that it went out on this journal's letterhead. Granted, we don't have the profile of a magazine with millions of readers, but you'd think any self-respecting salesperson would gladly follow up possible exposure of any kind. At the very least, you could expect a form letter of some sort to acknowledge receipt of the enquiry. The result? Of 14 enquiries, 3 responses were received.

This is a sad example of lack of attention to potential customers. I have encountered a similar lack of follow up to enquiries of other companies in the past, (in other industry sectors, so it's not just the HRV industry that's slack).

Are these companies doing so well that they can afford not to follow up product enquiries?

There's a lesson here for all of us - don't ignore those enquiries when you're too busy. Even if you can't or don't want to take on a job, at least acknowledge the enquiry. It could pay back when you are remembered to their friends and associates

*Richard Kadulski*  
Richard Kadulski,  
Editor

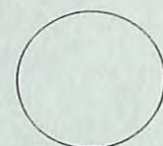
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## Surfing the 'net: a primer Browsing for Building Technology Information

by Martin W Liddament  
*Head, Air Infiltration and Ventilation  
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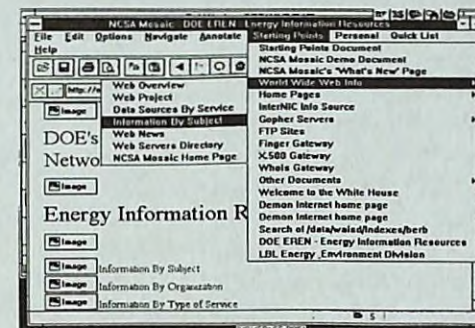
You've heard about the information highway, and the Internet. By now, your eyes probably glaze over at the mere mention of it. Is it all hype? Blown out of proportion like the Windows 95 hype? Besides, what good is it on the job site?

It's fair to be sceptical. It should be treated like any other tool - useful but with limits. Like it or not, it is a tool more of us are going to use. The Internet is rapidly expanding, providing a conduit to almost limitless sources of information. The Internet should be considered a giant library and bulletin board. Databases, reports, photographs, sound recordings and moving images can all be found. A brief exploration of the Internet shows that the Building Energy Efficiency sector well represented with a wide range of information already being readily obtainable.

The Internet has been available to universities and large institutions for some time, but it is only recently that access to small organisations and individuals has become widely available. The purpose of this primer is to show the range of information available and how easy it is to connect to the Internet. In most cases, the connection costs no more than a monthly Internet provider fee. Every major centre will have a local access number so that long distance toll charges are avoided.

### What services are provided?

The Internet offers a wide range of services. From a professional viewpoint, the most valuable are e-mail and the ability to tap into vast sources of data. It is also possible to establish your own information databases for either general



or restricted access. The Internet has been transformed by the development of the 'World Wide Web' (WWW). This can be likened to a vast network of information sources that is interconnected by countless paths.

The 'Web' is entered through 'Browser' software which operates under 'Windows' or Macintosh, as well as Main Frame computers. Each information source consists of a 'home page' which has introductory information in which 'key words' are either underlined or are coloured blue. By pointing the mouse and 'clicking' at these keywords, more information screens are recovered containing detailed information and yet further keywords. 'Browsing' is simply the process of 'pointing' at keywords and 'clicking'. This search approach may take you deeper into the same information source or transfer you to a related source on the other side of the world.

### How is the Internet accessed?

Becoming established on the Internet is a little tricky because commercial solutions are still being developed, but a full World Wide Web connection can be established in a matter of hours by following the instructions presented below. All the software needed to establish a WWW connection is provided by your Internet

provider and is also available free of charge from the Internet itself. The installation instructions presented refer to an IBM compatible PC although virtually identical instructions apply to other computing systems. To establish a connection you need the following:

**Computer:** the minimum is usually a '486' DX with 8Mb of RAM and at least 20Mb of available hard disk space.

**Telephone Line:** an ordinary telephone line is needed. This line only remains open when connected to the Internet, so it is not necessary to install a special high quality ISDN line or a permanent line for casual Internet use. All the examples presented in this primer are based on a standard phone line connection.

**Modem:** A 'modem' converts computer and Internet information into signals that can be transmitted along a telephone line. The minimum speed must be 14400 Baud. Many internet systems are transferring to new 28800 Baud speed which effectively doubles the information transmission rate. Modems not expensive, and most new computers are now packaged with them.

**Internet Service Provider:** The service provider is a commercial organization that connects your computer to the Internet System. There are many providers so it is essential to find one that gives you the correct range of services. Without defining the jargon, you need a provider that can give you a 'PPP' or 'SLIP' connection and your own Internet (IP) address. You will also be allocated an e-mail address. Ideally you need a provider with a local 'Point of Presence' (PoP). This simply means that the Internet connection is



made through a local telephone exchange and hence no long distance charges are incurred. A local connection also reduces the risk of line noise. Some providers offer unlimited connect time for a set monthly fee (\$20 - 30.00) or a fee for a set number of hours per month with a charge for extra time. Typically, there is a set-up fee to open the account and will include the necessary software.

One question you need to ask is how many clients they have, and how many phone lines. A very low number of phone lines could mean difficulty in getting access because of heavy traffic. This is a problem that plagues some community based providers (the "freenets")!

**Software:** Software refers to the computer programs you need to enter Internet through the World Wide Web. Provided you have selected the correct Internet provider, you will already have been supplied with all the tools necessary to run e-mail and to download WWW software from the Internet. 'Downloading' is undertaken using the 'File Transfer Protocol' (FTP) and 'get' commands. These tools are very easy to use and are described in your Internet provider manual. The software you need to download from the Internet are:

i) **Chameleon sampler:** This software is also obtainable by 'ftp'. It contains many useful tools but the all important programme for a WWW connection is 'winsock.dll'. This makes a 'Windows' connection into Internet.

ii) **mos20b.1.exe:** This is the WWW Browser software itself and is known as 'MOSAIC'. The significance of MOSAIC is described in more detail in Reference (1). This version of MOSAIC is obtained by 'ftp' to the Internet Address: "ftp.ncsa.uiuc.edu"

iii) **w32sOLE.exe:** This program may be obtained from the same source as MOSAIC. It is needed to get MOSAIC to work on Windows 3.1. It is not needed if you use Windows for Workgroups v3.11 or intend to use Windows 95.

iv) **Iviewp1a.zip:** Also available from (ii) above are a range of software 'viewers'. The particular viewer recommended enables images to be downloaded at spectacular resolution, including those transmitted by the Space Shuttle and the Hubble Telescope. Other viewers for sound and video clips can be downloaded from the same source. Some information sources include special viewers for converting data files into full-colour print ready reports.

No other software is needed. In all cases, the software listed contain "README" files explaining how the programmes need to be set-up. For the items described, this turns out to be very straightforward and is no more complex than installing any other type of Windows software. The other must have reference is the Canadian Internet Handbook. This provides easy to understand descriptions of operating systems, as well as contact names and addresses.

### Starting a Session

If you are lucky, a WWW connection will be established at the first attempt. If installation has failed, a range of help and frequently asked question pages will assist you in solving your problem.

A session is initiated by running 'Chameleon' to establish a 'windows' link

between your PC and Internet; this puts you 'on-line'. MOSAIC is then initiated (normally by double clicking an icon) to give you a default 'home page'.

### Browsing the Internet

One way to begin browsing is to point and click the on 'Starting Points' of the home page toolbar. This yields a 'drop down' menu from which 'World Wide Web' info' may be selected. Then, from the next displayed menu, 'information by Subject' can be tried. From here the field is wide open. Fruitful information can be obtained by 'clicking' on 'energy', 'engineering', 'environment', 'government departments' and a whole range of other subjects. The address of any interesting source of information can be stored at a 'click' for instant retrieval at a later date.

Some of the information retrieved in only a few minutes of browsing is illustrated in the attached figures.

- From the US Department of Energy came a comprehensive buildings energy bibliographic data base. References and abstracts could be located by 'free text retrieval' or by searching specific fields (e.g. author search).

- Access to the European THERMIE programme yielded details of newsletters and other reports, many of which are

### Internet addresses

Internet addresses are arcane and horrendously complex. Mistyping a single '.' or '/' will have the computer telling you off! Typical Internet addresses (but interesting ones to check out):

<http://www.nrcan.ca> (Natural Resources Canada home page)

[http://nrcan.gc.ca/nrcanhp\\_e.html](http://nrcan.gc.ca/nrcanhp_e.html) (Natural Resources Canada page that provides links to all kinds of other sites, including Canadian Airlines flight schedules and declassified spy satellite photos)

<http://www.nrc.ca/irc/conprodeval.html> (Canadian Construction Products Evaluation Centre)

<http://www.web.apc.org/sustenergy/> (Renewable and sustainable energy associations listings and addresses)

<http://www.aibc.bc.ca> (Architectural Institute of BC, with links to other architectural and construction locations)

Fortunately the software makes it easy to browse by pointing to and clicking to another file (which could be a site on the other side of the world); you can also save the addresses you want to access frequently, without having to type in the address.

available by direct downloading.

- The International Energy Agency CADET provided information about their demonstrated energy end use programme.

- Other IEA projects included the Solar Heating and Cooling Programme.

All the information recovered could be searched and downloaded without charge.

It is also possible to locate commercial home pages through which information

can be reached via a pricing structure. Commercial pages are used to market books, products and services.

By following the instructions outlined in this primer, it is possible to enter the Internet system and find much information related to building research and application as well as a comprehensive e-mail system and the opportunity to put your own information on the World Wide Web.

For the building industry it could offer

instant access to updated product information and reduce the need to stockpile vast quantities of product literature which goes out of date quickly. ☼

### Reach Solplan Review via e-mail

We've hooked up to 'net; now you can reach us by e-mail. Our address is:

[solplan@cyberstore.ca](mailto:solplan@cyberstore.ca)

## e-mail: how it works (or don't get rid of your Fax yet)

E-mail is simply a means of communicating with others hooked up to the network. Like the FAX, the message is sent to the recipient immediately. Unlike the FAX, which most of us now have and react to the instant we hear the clatter of the machine, the e-mail message is delivered to a mailbox. You actually have to go to the mailbox and check for mail, as you don't get a message on your computer screen telling you that you've received mail. It's not unlike the situation for those who live in rural and suburban areas who have to go to a common mailbox or post office to collect their mail.

The other limitation is that if you want to send a graphic or some other material with your message, you don't just put a photocopy into the machine - you have to scan it first into the computer. Nor can you just do a quick sketch on a piece of paper and mail it to your supplier, client or architect for comment and discussion, like you can with a FAX. In order to do these things with E-mail you have to have a scanner, which means extra hardware and software, or do it right on the computer - not always the easiest thing to do on the job site.

On the other hand, if you already have the message in your word processor, (and it can be a long document) it can be sent anywhere in the world instantly for no

extra cost - no long distance charges for the phone line like with the FAX.

### What do you get on the Internet?

There's lots of information to be had; much of it is resource lists - where to find what, who's written what, etc. not unlike the catalogues and reference lists you can find in a major library. The big difference is that you have to spend time searching for it, as there is no central registry. Just think what would happen at the public library if someone dumped all the card index cards into a pile on the floor. Sure the information is there, if you spend some time looking through the cards. The internet is like that - one site will lead you to many others, but until you know your way around, you will spend time searching.

Most of the information to be had will be either material that's in the public domain that someone has loaded into the system: indexes and resource lists, government documents, or commercial information. For the construction industry this is where the real strength will be. Manufacturer's literature can be kept up to date on a regular basis, without the need to print and ship large quantities of paper. When you're looking for a product

type, you'll get access to all suppliers - not just those in your local area, or who've advertised in Sweets catalogue or a similar directory. Some of these product directories are already appearing.

Copyright material will be more limited. For example, Solplan Review relies on its subscription base to finance the publication, so there is no commercial interest in publishing on the 'net' unless there was a charge every time someone accessed the material. This is what is happening on some commercial databases, which can be accessed through service providers such as Compuserve and America Online.

### Want to find out more?

There's many books out there. By far the best source of practical information is the **Canadian Internet Handbook** by Jim Carroll and Rick Broadhead, published by Prentice Hall Canada. This book is updated every year, and contains background information on the internet as well as listing service providers, useful addresses, and much more than you're likely to need. ☼



## Non Toxic Termite Barriers

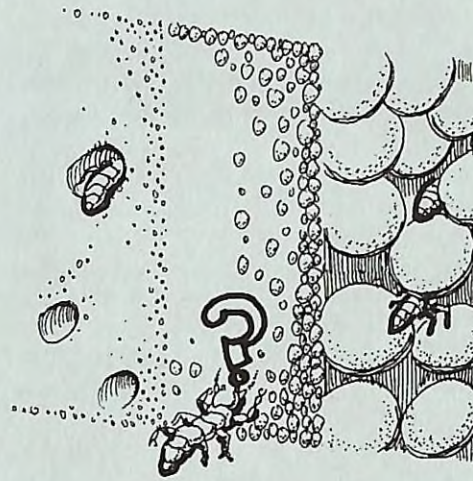
Underground termites are the most destructive insect pests. It's worth noting that termites are not limited to warm southern climates, as over 20% of Canadians now live in termite infested areas. With urban growth and the continuing spread of infestations, termites are becoming an increasing problem in Canada. Termites are most prevalent in southern Ontario and southern British Columbia. In Ontario termites are an introduced pest.

Our housing stock is not chemically pre-treated to prevent termites as is common practice in warmer climates. Because of the age and density of the housing in Toronto there has already been extensive damage. It's not just milder climate zones that have been affected. Termites have also been found in Southern Alberta, and even in Winnipeg.

Conventional termite control entails the use of large amounts of persistent chemicals to create a toxic barrier in the soil under the foundation of a structure. This large quantity of toxics close to human habitation is a health hazard and raises environmental concerns. The Urban Entomology Program in the faculty of Forestry at the University of Toronto was established to find alternatives to the chemical barrier method of control.

### What are termites?

To understand the problem, you have to understand a bit about the pest. Ter-



mites are small, delicate insects which dry out readily if removed from their humid habitat of soil tunnels and galleries in wood. The source of their destructive power is that they live in large colonies ranging in size from about 1 to 9 million individuals.

An infestation in a building is only a portion of a larger population linked by a vast system of subterranean tunnels. Termites can always be found in the yard before they enter a structure and most of the population remains outside of the structure feeding on other available sources of wood or cellulose.

A colony of 5 million can consume 400 grams of wood per day or 146 kg per year. This is equivalent to about 40 eight foot lengths of 2 x 4 lumber. That is why under ideal conditions, a typical house could be severely damaged in one year.

### How to termites get inside?

Fortunately colonies are usually spread over half a block or more and most feeding happens outside of structures, including all types of wood in soil contact. In the city they feed on dead portions of live trees, stumps, fences, decks, garages, firewood piles, wood retaining walls, wood edging, scrap lumber piles, etc.

Termites can only enter by tunnelling. Termite tunnels go through wood that is

in soil contact and that makes bridges between the structure and the ground or they build shelter tubes through foundation cracks or voids or over foundation walls. These tubes are covered runways that prevent the termites from drying out when travelling over exposed surfaces above ground. These are the termite versions of our covered climate controlled overhead or underground walkways found in most Canadian cities.

Termites cannot penetrate concrete so to gain access to wooden components supported on a concrete foundation they have 3 options: 1) they can tunnel through wood in soil contact, 2) they can build exposed shelter tubes up foundation walls, or 3) they can build a hidden tube through a crack, concrete joint, or hollow void space.

### Termite Shield

The oldest type of physical barrier is called a termite shield. This is simply a strip of sheet metal (ideally a non-corroding metal such as aluminum) that is placed beneath the sill plate to prevent termites from entering the wood structure. When properly installed termite shields are an excellent preventive measure. Termite shields of course require extra care if the basement is being insulated in the inside.

Another approach is to create a physical barrier outside the building that will prevent termites from tunnelling. Sand barriers have been proposed as a non-toxic alternative to the chemical barrier. They do not represent a hazard to humans as chemical barriers do which can break down chemically. The principle is that coarse sand particles are too large for termites to move, and the spaces between the particles are too small for the termites to crawl through. In addition, sand barriers don't leach through the soil and therefore to not pollute ground water as chemicals do.

At a certain size particles are either too big for termites to grip or too heavy for termites to excavate. The upper size limit is determined by how the particles pack and the resulting dimensions of the spaces between. For aggregate barriers to be effective the spaces between the grains must be smaller than the cross-sectional dimensions of small worker heads so they can't crawl through.

Sand barriers will obstruct the termites' ability to tunnel and explore along the foundation surface. It is the exploratory tunnelling along the surface that leads termites to discover cracks and gain access to the structure. These have recently been commercially developed in Hawaii and Australia. These products use highly uniform particles in a very narrow particle size range. However, because of the relatively small size of the market here, such a highly screened product does not appear commercially feasible.

Sand is visible, so it can be more easily repaired if necessary, but it is difficult and expensive to install as it has to be applied in a 15 cm (6 inch) layer. In Hawaii termite barrier sand is used instead of sub-slab bedding aggregate thus reducing the cost of installation.

Lab studies have found that particles sized from 1.4 to 2.8 mm are impenetrable by termites.

Mixtures, unlike separates, having a variety of particle sizes, are able to pack in configurations which more effectively occupy interstitial spaces.

Guidelines for the effective particle size ranges were less than 25% fines (1.4 to 0.22 mm), at least 50% in the range of 1.4 to 2.8 mm, and coarse particles (2.8 to 6.3 mm) consisting no more than 50% by weight. If fine particles made up 35% or more of the aggregate mixtures, the impenetrability is lost.

Field tests were conducted with five potential barrier sands supplied by southern Ontario firms. Barrier layers 5, 10, 15, and 20 cm thick were tested. The overall failure rate of these tests after two years was only 4% even though all five materials were slightly outside recommended distribution limits. The tests showed that barriers should be at least 10 cm (4 inches) thick. Such barrier sands provide a substantial reduction in the risk of termite attack and when used in conjunction with non-wood foundations the level of protection would likely be comparable to chemical barriers.

The cost of retrofitting sand barriers to existing structures with basement foundations would not be competitive with chemical treatment. Retrofit applications therefore would probably be limited to cases where there are special health concerns such as chemical hypersensitivity or special environmental concerns such as a nearby well. The most likely applications of sand barriers would be post hole applications, shallow perimeter applications around structures, and preventative pre-construction applications for structures with slab-on-grade type construction.

Installation of sand barriers prior to building construction is the least expensive approach and provides the most effective protection. The substitution of barrier sand for sub-slab bedding gravel would probably be possible with little difference in cost, provided adequate site drainage is also available.

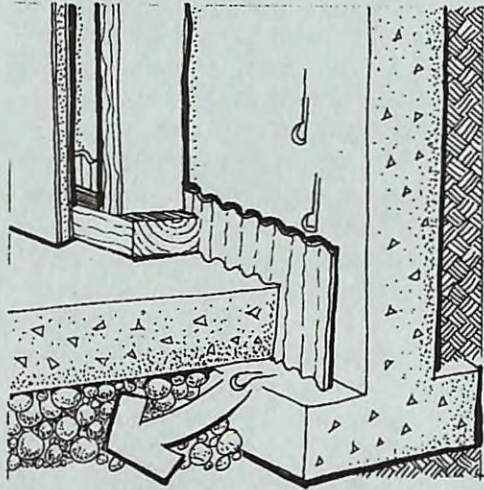
*Development of the Sand Barrier Method of Excluding Termites*  
By Timothy G Myles, University of Toronto for Canada Mortgage and Housing Corporation

### Points of Termite Entry

Wood in soil contact  
exposed foundation walls above grade  
hollow spaces in foundation walls opened by cracks in block walls or double foundation walls with hidden voids.  
Cracks in poured concrete walls.  
the joint between the footing and the foundation wall  
cracks in the footing  
the cold joint between the footing and the floor slab and the shrinkage gap between the floor slab and the wall  
cracks in the floor slab



## Keeping basements dry



It's known that if your customer doesn't see any water in the basement, they won't complain about a leaky basement.

There are two ways to keep basements dry: build the perfect foundation wall that will never leak, or accept that you may have a leaky foundation so detail it to remove the water before it becomes a problem.

Two Ontario builders weren't thinking about inventing a new product when they started looking for a better way to keep basements dry. After 5 years of experimenting, they've applied for a patent for the Leak-Bye a product they say will put an end to expensive and time consuming call-backs for wet basement floors caused either by condensation or hairline cracks in the foundation.

### What is this magic new device?

It's a simple and inexpensive wavy plastic ship similar to the green ribbed edging popular with gardeners for edging flower beds. Placed against the foundation wall it leaves tiny drain holes which catch any water running down the wall and direct it through the floor to be carried away by normal sub floor drainage.

Before the floor is poured, the base of

a foundation has to be skirted with the Leak-Bye. This now forms the edge for the floor slab.

House wrap, applied inside out so it breathes out but not in, is installed on the inside of the basement wall to direct any moisture down the wall to be caught by the open channels provided by the Leak-Bye. The inside of the basement wall is insulated and studded as normal. The outside of the foundation is treated in the normal fashion.

The Leak-Bye has now been used on about 10 new houses, and also as a retrofit. Not one of the basements where it has been used has leaked a drop.

It's a simple foolproof solution that doesn't take much training to use, and only costs about \$100 for an average new basement.

If this product is used in areas that have radon or soil gas problems, you may have some concerns. You'd have to be very careful to caulk and seal the interior framing and finishes, to ensure a tight air barrier to avoid any possibility for the migration of soil gases into the basement.

The product is available through the inventors.

Information: J.R. Plume Construction  
RR #3

Mount Forest, ON N0G 2L0

Tel: (519) 323-1833

## New Low-e Glass

Low-e coatings have improved the thermal performance of windows. However, all low-e coatings are not equal.

Generally the most energy efficient coatings have been soft coats, which as the name implies, are soft and subject to deterioration if exposed to air for any length of time. Soft coats have always required trade-offs: they are more difficult to fabricate, easy to scratch, and have lower shading coefficients resulting in lower passive solar gains in exchange for better insulating properties. The special handling required by soft coat low-e glass has meant that not all window shops are keen to use it.

Libbey-Owens-Ford Co. has introduced a new Energy Advantage Low-E glass that has improved the emissivity rate (down to 0.15 from a previous 0.20). The changes improve the performance of the glass without diminishing any of the other performance characteristics or colour neutrality. As a result, the centre of glass U-value is 0.33 (R 3.03) an improvement from a previous 0.35 (R 2.85). By comparison, a typical soft coat has a U-value of 0.32 (R 3.12).

The lower emissivity and U-value means that the insulating properties of Energy Advantage glass are improved. For instance, a window with this glass could improve its ER rating to -9 ER, down from -10 ER when using the older version.

The new numbers could also help builders meet increasingly stringent energy codes. What all of this adds up to for consumers is more comfort and savings, and smaller window manufacturers now have access to the most efficient glass.

The numbers may seem small, but as windows are weakest link in the building envelope, any improvement will mean a significant reduction to the overall building heat loss. ☼

## Moulds in the Home

Many types of bacteria have been found in indoor air, sometimes in high concentrations. Most of these are species normally associated with skin and nasal surfaces and do not contribute to disease or otherwise affect indoor air quality when found in normal concentrations.

Generally the range of fungi in normal indoor air is identical to that found outdoors. If fungi start to grow indoors to the point they fruit and give off spores, it will affect human health, as there is consensus that fungi should not be allowed to grow in buildings.

High concentrations of bacteria and fungi are normally a sign of poor ventilation. In the last five years fungi have been identified as the most important biological aerosols that affect health in indoor air. There is no single mould that is a concern; a group of "indoor moulds" have been noted in buildings in several parts of the world.

Optimum conditions for the development of moulds can develop many ways. It is easy to understand that catastrophic events such as floods are generally followed by mould growth, but we don't realize that building methods or management practices can also contribute to mould growth. Fungal growth on a building material increases the chances of exposure to a single species of mould, its allergens and toxins and this, in turn will affect the health of occupants.

The whole area of fungi inside buildings is a new area for research. Up to now, most studies have generally looked at the relationship of moulds and dampness to various respiratory and non-respiratory symptoms. However there have been some advances in our understanding of the harmful effects of unusual, but not necessarily extreme exposures to fungi. Toxins present in fungal spores have long been known to affect respiratory functions as inhaling fungal spores can trigger aller-

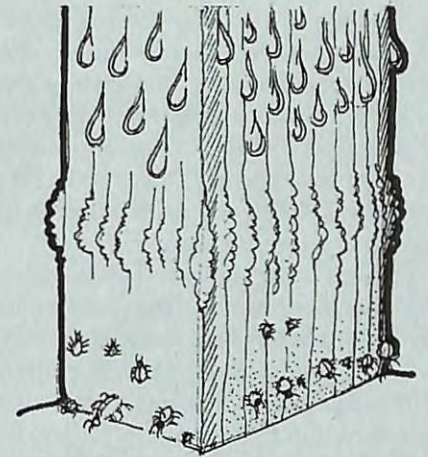
gic responses. Some compounds have powerful even toxic effects on the immune system. In the extreme, some species are suspected to be carcinogens.

Fungi will grow on various building surfaces at various moisture levels. Monitoring of mould growth on interior walls has shown there can be a succession of moulds on poorly insulated walls which become progressively wetter with condensation as winter advances. For example, water loving species will grow where materials are very wet. Drying a wet area will not eliminate all moulds, but will result in a succession of other species that survive in dryer conditions. Several recent studies have found that xerophillic ("dry loving") species that are able to grow at low moisture levels can form an appreciable percentage of the population.

Until recently, the thinking has been that moisture content (MC) and relative humidity (RH) are the determining factors for microbial growth that affect indoor air quality. However, microorganisms don't obtain the moisture they need from the atmosphere but from the moisture contained in the material on which they grow. The moisture in the material is absorbed from the atmosphere. In other words, the relative humidity of the air has only an indirect effect on fungal growth by affecting the moisture content of the solid surfaces.

Most materials always contain a certain amount of water held in place by chemical bonds. This moisture is not influenced by the RH, and is not available to microorganisms; rather, humidity determines the amount of "free" water present in the material. The free water is that which may be absorbed when condensation takes place and is the moisture that becomes available for microbial growth.

The relationship between air temperature and relative humidity is known, but



walls or other surfaces in a building are often cooler than the air within the building. For example, in a still room with no air circulation the air temperature in the centre may be 20°C with the RH at 60%, but the wall temperature could be 15°C with a RH of 80% at the wall surface. As a result, over time moisture from the air will be absorbed by the wall surface and could create conditions that sustain microbial growth.

To determine if microbial growth is possible or not, it is necessary to know at what relative humidity the air is in equilibrium with a given moisture content in a material. For any material, this equilibrium relative humidity is referred to by scientists as its 'water activity' ( $a_w$ ). Air and surface temperatures have a bearing on the moisture content and the  $a_w$ .

Because of different microscopic structures and varying affinity for moisture, different materials with the same  $a_w$  may have quite different actual moisture content. For example, at a  $a_w$  0.80 the moisture content of gypsum plaster is only about 0.7%, bricks 0.1 - 0.9% but wallpaper 11% and softwood around 17%.

Although fresh gypsum does not supply the nutrients for mould growth, dirt on the wall may contain enough inorganic and organic nutrients so that at a moisture content of 0.7% it could support as much microbial growth as wallpaper with a MC of 11.3%.



It is important to remember that there are many species of fungi, some of which are able to grow at low moisture levels. The condensation which happens when the temperature of a surface is at or below the dew point can allow mould spores to germinate and grow regardless of the ambient relative humidity, so that once they start growing, they keep going.

Infrared mapping and surface-sampling for moulds in homes has shown that where there was an uneven distribution of water in gypsum coated walls the pattern of mould growth varied with location, as well as time.

Recent building practices and occupancy habits have increased the risk of condensation because there is a greater temperature difference across the building envelope, and in fact thermal bridging may accentuate these conditions. This means that when moist air permeates a porous construction material which is at a temperature below the dew point, the

resulting condensation within the material can act as a reservoir of water which will permit the mould growth to continue even when the moisture level and relative humidity drops have dried the surface so that in theory growth is prevented. A wet substrate can support growth until its moisture content falls to a level at which growth is not possible.

This means that night setback of thermostats, or lowering the temperature for a few days when occupants leave for a winter vacation could allow the development of moulds that will persist for a long time after the residents return. This could be a major problem in electrically heated houses, where each room is on its own thermostat, and owners have a tendency to zone the heating system, with "cool rooms" and warm areas (typically, it is the bedrooms that will be kept coolest, this ensuring optimum conditions for condensation and moulds).

Every microorganism has its own characteristic moisture and temperature requirements. Most moulds that are a concern in buildings have minimum temperature needs in the 5 - 10°C range and optima of 25 - 35°C, with limited or no growth above 40°C. This coincides with the temperature range of all our buildings.

Since growth of moulds that affect human health is avoidable, it is our duty to use building techniques and materials and to manage buildings in a way that prevents their growth.

*Adapted from Humidity and Fungal Contaminants, a paper by Brian Flannigan (Dept. of Biological Sciences, Heriot-Watt University, Edinburgh) and David Miller (Plant Research Centre, Agriculture Canada) and presented at the Bugs, Mold & Rot II Conference.*

## Humidity Meters

Humidity is an important criterion for assessing indoor air quality and the effects of moisture on building materials and contents. Moisture is also a major problem in all buildings. In winter buildings can be too dry, so humidifiers are used in some areas. At other times, you can have too high a humidity. The optimum humidity range is 40 to 60% but depending on the time of year, 30 to 70% will be acceptable.

To know if there are moisture problems in the home and what kind they may be, you have to know what the humidity level is. Homeowners with moisture related problems are often advised to check the relative humidity in their homes. A simple, inexpensive humidity sensor, which provides a reasonable measurement of humidity, is needed. However humidity is a difficult environmental condition to measure accurately.

Humidity is measured with a hygrometer. There are two types of meters: those that measure fundamental properties of air, and those that measure wet bulb temperatures and dew points, such as psychrometers and chilled mirror devices.

The simplest and not inexpensive hygrometer measures the effect that moisture has on a material, and are known as strain hygrometers. Variations in humidity cause the moisture content of materials to change resulting in expansion or contraction of materials (materials such as human hair, cellulose and synthetic fibres are used). The dimensional changes of the material are calibrated to provide humidity readings.

Strain hygrometers are inexpensive and are not greatly affected by the presence of airborne contaminants. However, they have a tendency to undergo deformation over time resulting in long-term drift of the readings.



Resistive hygrometers have sensors that use either salt-saturated filaments or metal grids embedded in a casing. The resistance of the probe varies with the amount of moisture. The voltage or current passing through the probe is a function of the

(Continued on page 17)



## R-2000 Monitoring Data Review

R-2000 houses have been monitored extensively over the years, but as the technical requirements were modified recently, and a new version of HOT-2000 issued last year, it has been necessary to review just how today's homes operate (with so many new appliances in the average home). The heat provided by lights and appliances can be an important part of the space heating, especially in energy efficient houses. These internal heat gains are accounted for (as defaults) in HOT-2000 simulations.

Recent detailed hour by hour monitoring data from a limited sample of seven houses in two regions (Prairies and Ontario/Quebec) was analyzed by SAR Engineering. The study may not be representative of all R-2000 houses, but it gives a good indication of the performance to be expected and can be used to examine performance in detail.

The analysis showed that R-2000 houses should be able to reduce the space heating energy demand by about 50% when compared to conventional houses of comparable size.

The houses maintained temperatures, humidities and carbon dioxide concentrations within accepted ranges. Winter main floor temperatures averaged 21.1°C, basement temperatures averaged 19.6°C. The space average daily temperature swings in the living areas ranged from 1.8°C to 3.2°C with an average of 2.5°C. This is important to know, as large solar gains can contribute to serious overheating and occupant discomfort.

### Solar Gains

Passive solar gains can give free space heat, mainly through the south windows. The rule of thumb is that a maximum of 6 to 8% of south facing windows (relative to floor area) for light-weight frame construction buildings is the optimum area. However, this area should only consider the thermally coupled floor area. In other

words, only that floor area seen by the south windows - not the entire house floor area.

Two of the houses had large south window areas, and hence large solar gains. This provided much higher temperature swings because there was no direct solar contact with the thermal storage, nor was there any effective system for distributing excess heat from the solar gains or the fireplace. (These houses did not have a forced warm air heating system which might have distributed the excess heat). The average maximum temperature swing for all the houses was 10°C.

With the development of high performance windows there may be pressure to increase window areas - including south windows. Even though high performance windows reduce the solar transmissions (compared to clear glass) there could still be serious overheating unless attention is paid to proper sizing of south windows.

### Ventilation

Winter ventilation rates averaged 0.29 air changes per hour (calculated natural air leakage - including the effect of unbalanced fans - averaged 0.21 air changes per hour, for a total of 0.50 air changes per hour). With these rates of air change, and the very low moisture content of air in winter, humidification was necessary to keep relative humidities in the 30 to 40% range.

October to April interior relative humidities averaged 16% to 38%, though more typically in the 32 to 38% range. Summer relative humidities went as high as 84% but the average interior relative humidities were from 40 to 52%.

### HRV Efficiency

Sensible heat recovery ventilator efficiencies averaged 49% which is significantly less than their rated values. When duct losses and latent heat losses were considered the efficiencies of all the

ventilation systems were less than 40%. HOT-2000 has been modified to include HRV duct heat losses. A latent heat and moisture model is under development.

### Carbon Dioxide

Average carbon dioxide concentrations were 400 to 600 ppm so this does not appear to be a problem with ventilation rates of about 0.3 air changes per hour. Summer CO<sub>2</sub> levels as high as 1,900 ppm were noted during test periods when the ventilation system was turned off - indicating the necessity of having a well-designed ventilation system. This house does not have an air recirculation system (hot water space heat), so pollutant concentrations may build to high levels in one part of the house.

### Hot water use

Average hot water use was 245 litres per day in the summer and 256 litres in winter, which is equivalent to 11.1 to 12.5 kWh per day. The natural gas domestic water heater efficiencies ranged from 52 to 58% over the year and 66 to 70% for the Edmonton house which had a combined natural gas space and water heating system.

### Electrical use

The average electrical energy consumption (for lights and appliances) is 24.7 kWh per day.

An additional 8.1 kWh per day is used to run fans and pumps during the winter.

### Total Energy Consumption

For the seven houses analyzed, the space heat demand averaged 261 MJ per sq. meter of floor area, and 56.6 kJ per sq. meter of floor area per Degree Day (18°C). This is still almost 50% lower than for conventional houses of a similar size.

Total energy supplied (utilities, water heating and space heating) averaged 150.6 kWh per day (198 GJ per year).



## R-2000 Feedback

What has been the impact of the R-2000 Program? A recent evaluation of the program has found that the energy saved by all certified R-2000 houses from 1981-1994 compared to Conventional houses is 1.2 Petajoules, because an R-2000 house uses half the energy of a conventional house of the same age.

The impact goes beyond just R-2000 certified homes. Expert opinion estimates that the energy saved because of the program's influence on mainstream new home construction through new, more efficient products, improved building practices, and its influence on energy related building codes and standards is over 80 Petajoules.

1 Petajoule = 10<sup>6</sup> Gigajoules

An average house consumes about 100 GJ/year.

### Who buys R-2000 Houses?

A survey of R-2000 homeowners found that most are between 34-54 years old and they bought their R-2000 house new. Most are well educated (with post secondary education) and gainfully employed (24% are retired). Average household income is in the \$50,000 to 75,000 range. The average household has 3.3 people with children of all age ranges, but focused slightly in the 10 to 14 year range.

### What do homeowners have to say about their houses?

The major differences between R-2000 and conventional houses noticed by homeowners were:

higher energy efficiency (80%), specific energy efficiency technologies (50%) (vapour barriers; low E windows), higher

air quality (43%), more comfort/less drafts (36%), quieter operation (33%).

Comfort and air quality were the features with which homeowners were most satisfied.

Chief owner complaint is indoor air that is too dry, noise from HRV's and furnaces. Other complaints were about routine maintenance issues common to all new houses.

Most (2/3) learned about the program from the builder. What made them purchase their house? Overall construction quality, the energy efficiency features, the Builder's reputation, indoor air quality, the location, the price and dampness control.

Most of the homeowners paid extra for the R-2000 features - the average incremental cost was \$8,140. They would buy another R-2000 home and be willing to pay an extra \$10,700.

### Is payback important?

About 30% of respondents had actually calculated how much their energy bill would likely be before purchasing the house. 27% tried to calculate how many years it would take to pay off the extra cost through energy savings of the utility bill. On average it would take them 8.1 years to pay off the extra purchase cost, and most thought the resale value would be increased about \$11,000 for the R-2000 features.

### What about the health aspects?

There was a very low proportion of cigarette smokers among those responding. If this is accurate, R-2000 homeowners are either unusually health-conscious or have health problems that discourage them from smoking.

Most respondents reported the same or better health after moving into the house. ☼



## Silver Georgie Awards for the Great Canadian Reno-Demo Project

And you thought the editor had finished writing about this project - the renovation of an 80 year old house in North Vancouver that demonstrates environmentally responsible, energy efficient and healthy home approaches to home renovations. Since the last issue went to press we received news that the project has received two Silver Georgie Awards - sponsored by the Canadian Home Builders Association of B.C. to recognize excellence in the residential construction sector. Judging is done anonymously by a panel of judges brought in from outside the province.

Silver Georgie awards are finalists for the Gold Georgie Award, which are announced at a gala presentation mid October.

The categories in which the project was recognized are for Best Renovation under \$150,000, and for Best Environmental Achievement. ☼



## Canadian Home Builders' Association

### National Building Code

The 1995 issue of the National Building Code of Canada, the model code that is the model code for each provincial building code, is expected to be ready in December. The implementation of the code is up to each provincial jurisdiction having authority, and usually follows within a year or so. For the computer enthusiasts, a version will also be available on CD-ROM.

A series of code seminars has been scheduled across the country. These seminars have been broken down into Part 9 (housing) and Part 3 (commercial and large scale) sessions. The seminars will focus on significant changes that are being introduced. All builders should be receiving an information flyer.

(see calendar of events, p.19 for dates)

### Infrastructure Guidelines

The National Research Council will be putting together guidelines that would spell out appropriate performance standards for infrastructure. This could provide the opportunity to use new more cost effective options that may not be allowed now simply because municipal engineers may not be familiar with alternatives, and they tend to stick with the tried and true, no matter what. The guidelines would not be a new code or standard, but merely performance guides against which the regulators would have to measure and evaluate new technologies.

A number of major cities, as well as several provinces have indicated their interest in the project.

## Technical Research Committee News

### Canadian Technology Network

This is a national network of technical advisers that is being established by IRAP (Industrial Research Assistance Program) office at the National Research Council. This will be a one step shopping centre for technical assistance. The objective is to provide integrated, accessible path to information and services relevant to small and medium sized businesses using technology. This will mean that small sized businesses will be able to turn to the advisors for objective advice and assistance to identify, acquire, and adapt the most appropriate practices and technologies from across Canada and around the world.

The network will list not just government departments and agencies, but also other organizations.

A site on the Internet is being developed. Information is located at:  
<http://www.ctn.nrc.ca/ctn.html>

### Plastic Gas Vents

The Ontario Ministry of Consumer and Commercial Relations has issued a Safety Order requiring all Ontario owners of heating systems with high-temperature plastic vents to have these systems replaced by August 31, 1996 or their gas service will be suspended.

This order applies to Ultravent, Selvent and Plexvent plastic vents, high-temperature plastic venting systems to exhaust the products of combustion from heating appliances such as furnaces, boilers and water heaters. They were introduced into the market as early as 1988.

Over the past three years, these high-temperature vents have been installed primarily in conjunction with mid-efficiency heating appliances. The Underwriters' Laboratories of Canada (ULC) suspended certification of the products,

and sale of the plastic vents systems was banned in 1994.

The decision was made due to engineering and technical evidence that has confirmed that heating systems using these high-temperature plastic vents are defective. Premature failure takes place due to cracked pipes or fittings, or to loosened joints, and the risk of failure increases with the length of use.

Owners of new homes purchased after 1988 with these plastic vents installed at the time of construction are covered under the Ontario New Home Warranty Program (ONHWP) and are eligible to have their heating system corrected at no cost to the homeowner. For homeowners not covered by the ONHWP, major gas utilities are prepared to arrange for the correction of the system at preferential pricing and financing through their customer's gas bill.

In the interim, the ministry has advised affected homeowners that they can keep their systems safe through the current heating season by ensuring that their vent system has been fully inspected and repaired if necessary, maintaining their furnace, and installing a carbon monoxide detector (available at most hardware stores or other retail outlets).

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector. If you have any problems, technical questions, or suggestions for areas that need to be investigated, you are encouraged to contact your local Home Builders' Association technical committee or the TRC directly at:

Canadian Home Builders' Assc.,  
Suite 200, 150 Laurier Ave. West,  
Ottawa, Ont. K1P 5J4  
Tel: (613) 230-3060  
Fax: (613) 232-8214



## Ecologo Expands to Building Material

The Environmental Choice Program, a voluntary labelling and certification program, sponsored by the Ministry of the Environment was designed to support the improvement of the environment by reducing energy and materials consumption and minimizing the impacts of pollution generated through the use and manufacture of products and services. Products that meet the criteria are entitled to use the Ecologo symbol. Up to now, most certified products have been consumer goods and paper products. The major construction product has been paints. That is about to change.

A number of construction product guidelines are in the final stages of review. Once they have been accepted, products that meet the criteria will be eligible to use the Ecologo symbol. As a general principle, the guidelines cover the top 10% (from an environmental perspective) of the products in their category.

We are presenting some of the key requirements to give readers a flavour for the type of issues that are considered in designating acceptable products.

### Gypsum Wallboard

These will require a minimum of 10% recycled material by weight of the finished product; or a minimum amount of gypsum recycled from flue gas residues (a common by-product from power generating plants).

### Carpets

Carpets are a waste management problem (due to their relatively short life span) and indoor air quality problems. Because of the range of materials and yarns used, it was not possible to draft a simple set of criteria so a range of options was developed. These are based on a matrix of three parameters related to resource consumption and emissions, each with a range of

values. Each is assigned a point value, and points are totalled over all parameters, thus products with different environmental profiles will be able to qualify for the EcoLogo.

The issues considered include: percent recycled content, indoor air quality (IAQ), waste reduction, including a take back program, and percent waste reduced.

Carpets for residential use must: not be manufactured with biological inhibitors; meet or exceed all performance characteristics when tested according to the CCI/CRI Green Label Program; and be manufactured so that the total points assessed for percent recycled content, indoor air quality, and recyclability.

### Carpet Undercushion

These can adversely affect indoor air quality through chemical emissions after installation primarily due to volatile organic compounds (VOCs). The intent of this criteria is to reduce VOC emissions, reduce landfill waste, and resource conservation. As for carpets, a range of options are available.

### Resilient Flooring

This guideline deals with vinyl and linoleum floor coverings. The major concerns are indoor air quality through chemical emissions after installation (primarily volatile organic compounds (VOC's)). Vinyl flooring criteria will require manufacture without heavy metals, limiting total VOC emissions, and incorporate recycled and recyclable materials where appropriate.

The specific requirements are based on significant environmental impacts associated with the product life cycle. These relate to resource consumption and emissions and include amount of recycled content in the binder, indoor air quality, chemical emissions, and waste reduction.

### Steel Roofing

Steel-based roofing products will require a minimum of 50% by weight of recycled material in the metal base; and not incorporate coatings applied to the metal base that are formulated or manufactured with aromatic solvents, formaldehyde, or halogenated solvents, or manufactured with heavy metals. The products must also be accompanied by information regarding existing recycling programs for steel-based roofing products and instructions on proper disposal.

### Wood Roofing

Wood shakes and shingles will be eligible provided they are manufactured from wood that is harvested from forests in compliance with all applicable sustainable forestry legislation, guidelines and codes of practice in effect in the jurisdiction. While these may be weak or non-existent at the moment, once an appropriate certification system becomes available to recognize sustainable forest management, it will be referenced by this program.

The criteria requires that all wood fibre be utilized, and that "wastes" be diverted for use in other wood products or energy recovery. Western red cedar product must be made of wood fibre that is a by-product of an industrial process such as dimensional lumber production; be accompanied by information for the consumer on available options for diverting post-consumer materials from disposal; and be accompanied by information for the consumer on the preservation and restoration of shakes and shingles.

Treated shakes and shingles must be manufactured by a process that recycles the process wastewater.



### Particleboard

The environmental benefit of these criteria is through a reduction in the waste going for disposal, reduced formaldehyde emissions and increased use of agricultural fibre produced during the processing or harvesting of agricultural crops. To be acceptable, it will have to contain less than 10% roundwood by weight, and at least 5% recycled materials by weight. Particleboard manufactured from an agricultural fibre must use 100% agricultural fibre as the fibre source.

### Fibreboard

Products in this category include medium density fibreboard, hardboard, and low density fibreboard. The major environmental concerns in the production of fibreboard that will be addressed are air emissions, wastewater effluent and solid waste.

### Pre-finished Hardwood Flooring

The environmental concerns are the use of endangered species and indoor air quality. Eligible products will have to be accompanied by a guarantee of at least 10 years, minimize VOC emissions and be finished with a water-based or 100% solid UV curable coating and not be manufactured from woods listed by the Convention on International Trade in Endangered Species ☼

## Changes at Venmar Ventilation

The number of players in the heat recovery ventilation business is decreasing again. Nortek Inc., the parent company that owns Broan, has just acquired Venmar Ventilation. Venmar had previously bought Conservation Energy Systems (manufacturers of vanEE HRV).

With today's business ethic to maximize profit and rationalize operations, no matter the consequences, it is going to be

## Letter to the Editor

Re: Manufactured Wood Floor Systems Testing Program (TRC News, Solplan Review, July 1995)

The article correctly identified the difficulty the "regulatory sector" within the provinces is having in remaining current with the fast evolving engineered wood products industry. The issue of demonstrating in a conventional manner, "equivalency" to the applicable Building Code requirements remains pervasive and a barrier to innovation.

Regrettably, the article did not give due time or space to explain that an Engineer's approval of engineered wood products and systems is not the most expedient fashion used by most manufacturers of engineered wood components and system suppliers. The article was not apportioned the space to identify the pivotal role being played by the Canadian Construction Materials Centre (CCMC), a division of the Institute for Research in Construction at the NRC, in demonstrating "equivalency" and code compliance for innovative construction systems. A service that is increasingly being relied upon by jurisdictional authorities nationally and internationally.

Many leading engineered wood product manufacturers have given CCMC the opportunity to provide independent third party evaluations of their product lines. These innovative construction systems

and product lines are published in a "Registry of Product Evaluations" semi-annually. CCMC has the acknowledged written support of the Provincial/Territorial Committee on Building Standards, the Province of Ontario, Canada Mortgage and Housing Corporation, Public Works and Government Services Canada, and the Canadian Home Builders Association in support of the use of CCMC evaluations as a basis for determining the acceptability of products within the context of the R-2000 Program.

Helm G. Eckhardt, P.Eng.  
Industrial Technology Advisor,  
Canadian Manufactured Housing Association  
Ottawa, ON

*You are correct to point out that CCMC provides third party evaluations that are accepted by many jurisdictions. Regrettably, there are still many jurisdictions, where the authority having jurisdiction (usually the local building inspector) insists on a professional's seal to vouch for any system or product not explicitly specified in the Building Code, regardless of whether or not it appears in the CCMC listing. Ed.*

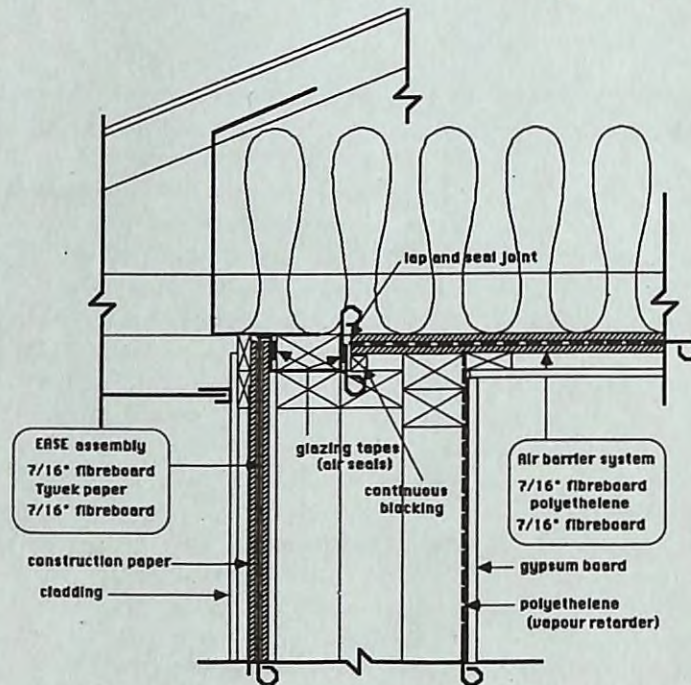
interesting to observe the impact of this acquisition on the products and new product development. Broan entered the HRV market recently, and with the large number of name plates that Venmar has been marketing under both the Flair and vanEE names, one wonders how long before some accountant is going to decide that if they reduce the number of products they may make more money (for the moment,

it's going to be business as usual).

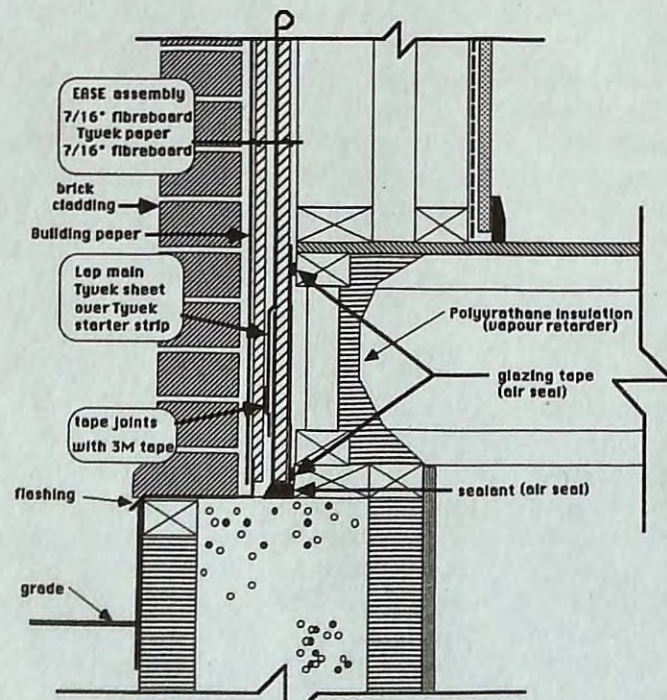
One hopes that this change will not impact the research and development of products for cold climates, rather than divert attention to the large market in the US sunbelt with its hot, humid climate conditions and problems. ☼



## EASE Air Sealing Approach



**APCHQ**  
EASE Air Barrier System  
WALL/CEILING CONNECTION DETAIL



**APCHQ**  
EASE Air Barrier System  
FOUNDATION - SILL PLATE-HEADER Detail

Every wall faces constantly fluctuating pressures acting on it. During stormy periods pressures can reach many hundreds of pascals. The dynamic pressure fluctuations are a concern as they can damage flexible materials, break caulking bead bonds, and also drive bulk moisture into a construction assembly - that is why there is some concern that polyethylene sheets, caulked and sealed can lose their air barrier function if they are subject to wide pressure variations.

The value of pressure equalization across the exterior cladding is to reduce rain penetration into and across the cladding. In a wall system that tolerates and removes any water penetrating the cladding without ill effect, this advantage may be of minimal value.

Air sealing the building envelope is important to good quality construction - for durability, energy efficiency, occupant comfort and health. A recently developed air sealing system called the EASE system, for External Air Systems Elements, was used in APCHQ's Advanced House in Montreal.

In the EASE system, the air barrier of the wall system is made up of a water vapour permeable membrane (TYVEK™) sandwiched, for structural support, between two layers of fibre board on the exterior of the wall. Fibreboard sheathing is a commonly used sheathing material in Central Canada, so this system is an adaptation of current practices.

The wall system has a well functioning, drained and vented cavity wall (but not a pressure equalized rainscreen) and the air barrier is shielded from the peak pressure differences.

Two wall sections were monitored by Morrison Hershfield (consulting engineers), one had brick cladding and the second stucco. Monitoring found that pressure loads across the air barrier membrane in both wall types were quite small; with most of the pressure across the wall system was carried by the exterior cladding materials. The peak pressure recorded across the wall system was in the order of 275 Pa.

The study found that the EASE air barrier system works well as an external air barrier. It did not allow moisture collection in the wall even though a temperature analysis showed that the Tyvek surface could at some times fall below dew-point of the air in the cavity. There was no indication of moisture collection in the cavity and there was no pressure difference carried across the interior surface.

It is interesting to note that the air tightness of this house when tested during construction (before interior finishes were in place); was 0.92 ACH @ 50 Pa. Well within the R-2000 limits.

*EASE Demonstration Project: APCHQ's Advanced House by Morrison Hershfield Limited for the Housing Innovation Division, Canada Mortgage and Housing Corporation*

(Continued from page 10)

relative humidity of the surrounding air. This type provides relatively accurate results, but at very low humidities (below 10 or 15%) the measurements become inaccurate. They are also comparatively slow (up to a few minutes) in responding to changes in humidity.

Capacitance Hygrometers consist of a pair of thin polymer plates between two electrodes. As with resistive hygrometers, the current passing through a probe is used to measure humidity. This type is quick to respond, and is accurate except for very high humidity. This type of hygrometer is expensive (over \$150) and only available from scientific equipment distributors.

**How efficient are the low cost (\$5.50 to \$100) units sold at major retailers?**

The accuracy and durability of hygrometers available to homeowners is highly variable. The least expensive hygrometers are not sold with any claims regarding their accuracy.

Six sensors available to the public for under \$100 and representative of their class were tested by Buchan, Lawton, Parent. These hygrometers have either strain or resistive sensing mechanisms. The objective was to: to determine the accuracy and to examine the durability of the units. It was also desired to develop a calibration procedure which can be easily followed by homeowners to ensure their hygrometers are providing correct humidity readings. This is necessary as the sensors can experience drift and require recalibration over time.

The accuracy was measured in a test cell that could be maintained at constant temperature with variable humidities. The hygrometers were subjected to a series of humidities representing the normal household extremes in the range of 0 and 82% relative humidity. Half the hygrometers tested showed significant zero calibration errors.

Prolonged exposure to freezing and condensing environments had no permanent effect on the performance of the hygrometers tested.

While there are hygrometers available to consumers for less than \$100 that are satisfactory for household use, significant zero calibration errors were observed in half the hygrometers tested, but with proper calibration, most could provide acceptable results. Cost itself is not an indication of accuracy. One unit, with a price of \$92 experienced significant drift that can't be connected by the user. Cheaper units had zero calibration problems which could be calibrated by the user.

Tested units that performed well in typical household environments:

Micronota 63-844 (\$29.00)

Bonaire BT-252 (\$30.00)

Less reliable:

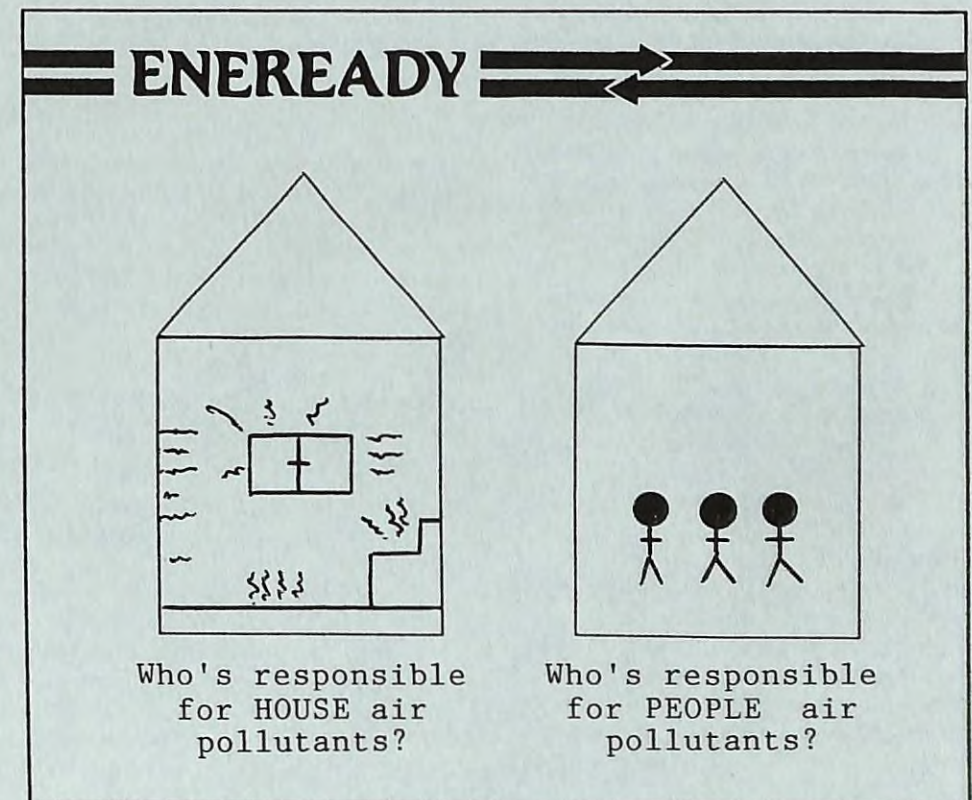
Taylor 5547 (\$9.00)

Taylor 5565 (\$92.00) experienced significant drift and cannot be corrected by user.

Hygrometers can be roughly calibrated by measuring the outdoor humidity and comparing the results to readings taken by at a local airport. When calibrating hygrometers with weather data, the following conditions should be met:

Outside temperature approximately 20°C, High pressure, clear, sunny days, Windy conditions, Readings are taken in mid-afternoon, and Hygrometer is shaded from direct sunlight.

*Investigation of Moisture Monitoring Devices by Buchan, Lawton, Parent Ltd. for Research Division, Canada Mortgage & Housing Corp.*





## Esoteric? Fringe technology? Outlandish Energy saving claims?

That's what the critics have called our HRS (heat recovery shower). Lets look at the facts.

People are showering longer and more frequently than ever before while all other uses of hot water in the home are declining. Water use for showers is increasing even though low flow showerheads are being regulated in new installations. Future trends in showering show that as teenagers mature, they are not giving up their 2 showers per day habit as bathing seems to be dying out as a routine cleaning method.

This means that water use for showers is taking on greater importance in the energy use of a home.

Hot water use for showers can vary widely from family to family. A survey we carried out suggests that the savings can vary from \$6 to \$98 per month with the average being \$28 (at \$.07 per KWH).

What happens with the water? It passes over the body straight down the drain! This means there is lots of opportunity to recover that energy. That's where our heat recovery shower (HRS) comes in.

A worksheet to calculate potential energy consumption savings was printed in the last issue of Solplan Review (#63 - July 1995).

Our HRS is designed with top quality components that we believe will give years of trouble free service. Our design allows for easy service features for those unforeseen problems:

1. An easily removable platform (cover) for direct cleaning of the heat exchanger core.
2. An easily removable heat exchanger core. (Just undo 2 brass pipe unions).
3. The microprocessor/valve/showerhead assembly can be removed as a unit. Just unscrew the plastic corner moulding, undo 2 brass pipe unions and then unscrew the complete unit from the wall.

Energy saving features - especially those with a reasonably quick payback, are still attractive to homeowners. That is why all builders should consider using this product. It's new, innovative, and produces savings too!

R-2000 builders should remember that there is an extra credit available for the use of an HRS.

### What about Grey Water Heat Recovery for all house drain water?

There is a perception that a whole house heat recovery system will be more comprehensive. This is simply not true. The maximum theoretical efficiency of a whole house system is 50%, because the whole house system's water flow rate to the hot water tank is only half the drain water flow rate. And there's not too much energy to be gained in toilet waste water. The draft report on the whole house grey water heat recovery system at the Manitoba Advanced House stated that to maximize efficiency, the heat should only be recovered from the high temperature and high water volume appliances.

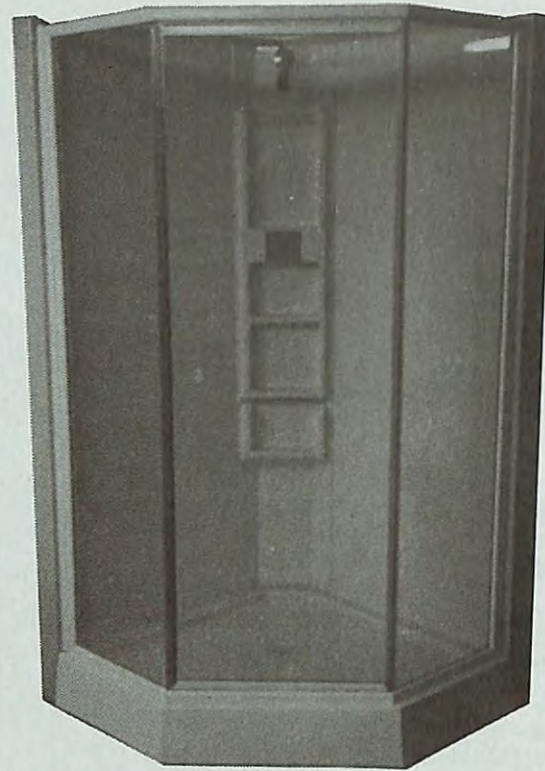
In the average house the shower uses the most amount of hot water followed by the dishwasher. The dishwasher uses the highest temperature water while the shower is number two. Our research has also shown us that these are the only appliances from which we should be recovering heat. They will probably account for 90% of all the hot water usage in the average home. This assumes that clothes washing is done exclusively with cold water (easy to do, with today's cold water detergents).

The HRS should be a feature in every house you build. For more information, write or call:

**Heat Exchangers NF Inc**  
26 Georgia Dr, Stephenville, NF A2N 2T5  
Tel/Fax: (709) 643-4046

Let us calculate what the energy savings will be when you install an HRS. Send us the following information: how many people in the home, for each person, the average length of shower, number of showers per week, shower temperature (warm, medium, or hot), local energy cost and fuel type.

We will calculate the monthly energy cost for hot water with a standard shower and with our HRS. Let the facts speak for themselves.



### What about cost?

The incremental cost of the heat recovery part alone is about \$400. We still have a few HRS units at a special price that reduces this to about \$175 which means that at this special price payback periods will be months, not years.

## Coming Events

**National Building Code (1995) Seminars**  
These focus on the latest changes to the code. Separate one day sessions for Part 3 (large buildings) and Part 9 (Housing and small buildings). Part 9 seminars are scheduled as follows  
For information: tel: 613-993-0435 Fax 613-952-7673

Oct 18 Edmonton, AB; Oct 20 Calgary, AB;  
Oct 23 Vancouver, B.C.; Oct 25 Whitehorse, YT  
Oct 30 Halifax, NS; Nov 1 Fredericton, NB  
Nov 3 St. John's, NF; Nov 6 Charlottetown, PEI  
Nov 20 London, ON; Nov 22 Hamilton, ON  
Nov 24 Toronto, ON; Feb 15 Aylmer, PQ  
Feb 20 Montreal, PQ; Feb 22 Quebec City, PQ

**October 31-Nov 2, 1995**  
Energy & Environment Conference, Toronto, ON.  
21st Annual conference of the Solar Energy Society of Canada Info: Fax 613-736-8938

**October 30-31, 1995**  
Home & Building Automation '95  
Radisson Hotel des Gouverneurs, Montreal, PQ  
Information: Tel: 613-990-7407

**November 29-December 2, 1995**  
Construct Canada: trade show and exposition  
Metro Toronto Convention Centre  
Tel: 416-869-0141

**December 4 - 8, 1995**  
Thermal Performance Of The Exterior Envelopes Of Buildings VI; Research, advanced technologies, new concepts, practical applications and case studies. Oak Ridge National Laboratory Thermal Envelopes Conference  
Box 2008, Bldg 3147; Oak Ridge, Tennessee 37831-6070; Attn: Pat Love

**January 17-18, 1996**  
Ontario Builder Forum: Technical conference and exhibit; Toronto, ON  
Tel: 416-447-0077 Fax: 416-443-9982

**February 16-18, 1996**  
Construction Business & Technology Conference; Presented by the Journals of Light Construction; Marlborough, MA  
Tel: 802-434-4747

**February 25-28, 1996**  
CHBA National Conference; Vancouver, B.C.  
Info: Tel: 416-443-9023

**March 4-6, 1996**  
Building Energy Hosted by the Northeast Sustainable Energy Association; Boston, MA  
Tel: 413-774-6051 Fax: 413-774-6053

## Insul-wall BUILDING SYSTEM

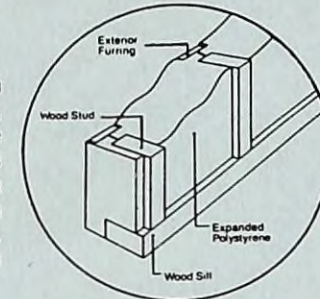
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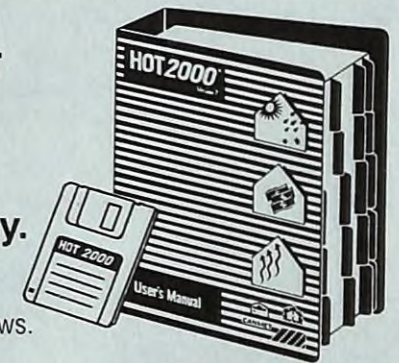
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### PLEASE FILL AND SEND OR FAX TO:

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**NEWEST  
EDITION**

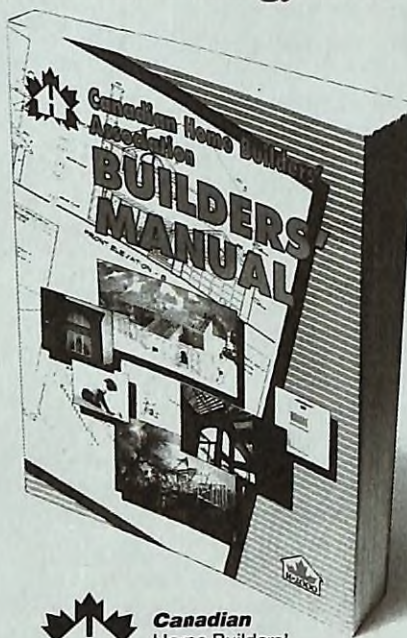
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\* The CHBA is a voluntary private-sector organization which represents the residential construction industry in Canada.

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